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<p>(54) Title: ARRANGEMENT FOR ESTABLISHING AN ALTERNATIVE TELECOMMUNICATIONS PATH</p>			
<p>(57) Abstract</p> <p>An arrangement for establishing an alternative telecommunications path between two telephone subscribers via a telephone exchange in the event of inaccessibility via the ordinary telephone line. A sensor circuit on the premises of at least one of the subscribers is adapted to monitor the telephone line between the exchange and the subscriber in order to detect one or more of the following parameters: voltage drop on the line without simultaneous line current; voltage failure on the line caused by line disruption; absence of dialling tone on the line; DTMF tones on the line; unidentifiable DTMF tones of the line; FSK signals on the line; ASK signals on the line; and pulse signals on the line. A selector circuit is connected to the sensor circuit to connect the telephone subscriber's telecommunications equipment from the telephone line to the alternative telecommunications path upon the presence of at least one of said parameters. The alternative telecommunications path is selected from the group consisting of: another monitorable physical telephone line; a telecom connection via the mains; a radio connection, e.g., GSM, NMT, VHF, UHF; an optical cable connection; an optical, non-physical connection; radio communication via satellite; and an ultrasonic communication connection.</p>			

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ARRANGEMENT FOR ESTABLISHING AN ALTERNATIVE TELECOMMUNICATIONS PATH

The present invention relates to an arrangement for establishing an alternative
5 telecommunications path between two telephone subscribers via a telephone exchange
in the event of inaccessibility via the ordinary physical telephone line.

Recently, the fact that alarm signals can only be transmitted from the alarm subscriber
to the security company via ordinary telephone lines has been a problem for a number of
10 security companies. This applies in particular to alarms of the type where, in the event
of an alarm, the central alarm unit on the subscriber's premises connects with a
telephone line and transmits alarm signals. For those alarm installations where
sustained telephone communication is maintained and where the alarm is signalled at
the security company by the non-appearance of control signals, this is not a problem of
15 equal magnitude at present.

In the standard alarm installations where, in the event of an alarm, the subscriber's
central alarm unit calls the security company via a telephone line, any burglar could
with relative ease cut the telephone line on the outside of the dwelling or commercial
20 property in which the alarm transmitter is installed. This will normally take place prior
to a burglary with the intention of preventing a burglar alarm from reaching the security
company. A possible alarm will also not get through if the line is engaged because
someone phones the subscriber at the instant the alarm is triggered.

25 Security companies have thus found it desirable that their alarm subscribers should be
able to transmit an alarm signal via an alternative telecommunications path, such as,
e.g., via the GSM network or another wireless network, so that the alarm system
functions even if an ordinary line disruption were to occur on the subscriber's line. This
would also enable alarms linked to security companies to be installed in places where
30 there is no ordinary telephone line, such as in a holiday cottage, in a boat, a car, a plane
and so forth. To date, this has only been possible by transmitting an alarm signal via

GSM data band or GSM text or via separate wireless telecommunication circuit owned by the security company. These methods generate relatively high costs for the security companies since they must update all their receiving stations in order to be able to receive signals of this type. The signals which are used today for alarm transmission are 5 within the voice frequency band 300 Hz – 3400 Hz, and the signals are sent as tones of varying pulse width in order to identify the subscriber. As mentioned, with the situation as it is today these signals are sent via ordinary telephone lines and are relatively easy to imitate.

- 10 The object of the invention is to provide a technical solution in order to be able to establish an alternative telecommunications path between telephone subscribers via a telephone exchange in the event of inaccessibility via the ordinary telephone line..

According to the invention, the aforementioned arrangement is characterised in that a 15 sensor circuit on the premises of at least one of the subscribers is adapted to monitor the telephone line between the exchange and the subscriber in order to detect one or more of the following parameters:

- voltage drop on the line without simultaneous line current;
voltage failure on the line caused by line disruption;
20 absence of dialling tone on the line;
DTMF tones on the line;
unidentifiable DTMF tones on the line;
FSK signals on the line;
ASK signals on the line; and
25 pulse signals on the line.

- A selector circuit is connected to the sensor circuit to connect the telephone subscriber's telecommunications equipment from the telephone line to the alternative telecommunications path upon the presence of at least one of said parameters.
30 Advantageously, the alternative telecommunications path is selected from the group consisting of:

- another monitorable physical telephone line;
- a telecom connection via the mains;
- a radio connection, e.g., GSM, NMT, VHF, UHF;
- an optical cable connection;
- 5 an optical, non-physical connection;
- radio communication via satellite; and
- an ultrasonic communication connection.

Additional embodiments of the arrangement will be set forth in the appended patent
10 claims and in the description below with reference to the enclosed drawings.

By means of the present invention it is possible to find out whether the ordinary, physical telephone line is intact, before it is decided whether the transmission of the alarm signals should take place via the telephone line or via the alternative
15 telecommunications path, e.g., via the GSM voice band. In connection with the invention, there is also a circuit which prevents unauthorised use of the telephone line, such as theft of call units, hacking, tapping and so forth. This circuit may optionally be included in said sensor circuit. The circuit places a galvanic short circuit between the wire pair in the telephone line if there is a voltage drop concurrent with the absence of
20 measurable line current. However, if a telephone set is used which is on the authorised side of the arrangement according to the invention, both a voltage drop and current will be measured, which indicates that the use is regarded as authorised.

There are many different types of alarms on the market today which have different
25 requirements as regards signal transmission and telephone lines. These may be requirements associated with line voltage, dialling tone and so forth. To enable such requirements to be met, it is an object of the invention that when it has switched to the alternative communications path, e.g., the GSM network, the communications path will function ostensibly as an ordinary telephone line. Therefore, implemented in the
30 present invention are line feed (voltage), ringing tone generation, dialling tone generation and a DTMF modem (transmitter and receiver). This contributes to the

presentation of the invention as a flexible product capable of implementation in different alarms with different functional requirements.

The said circuit for preventing unauthorised use of a telephone line is known per se and
5 described, for instance in Norwegian Patent Application No. 964998.

The invention will now be described in more detail with reference to the attached drawing.

- 10 The arrangement includes a selector circuit 1 which is adapted to monitor the telephone line 2 running between the telephone exchange and the subscriber. The sensor circuit 1 is adapted to detect one or more of the following parameters:
voltage drop on the line without simultaneous line current, which indicates theft of call units, hacking, tapping and so forth;
- 15 voltage failure on the line caused by line disruption;
absence of dialling tone on the line, which may be due to a fault at the telephone exchange;
- 20 DTMF tones on the line, whether identifiable or unidentifiable;
FSK or ASK signals on the line; and
pulse signals on the line.

If there is a voltage drop on the line without simultaneous line current, the sensor circuit is capable of blocking the telephone line by putting a galvanic short circuit between the wire pair in the telephone line. The sensor circuit 1 communicates with a control circuit
25 in the form of a microprocessor 3. Even though the present description and the point of departure for the invention have been based on the use in connection with alarm equipment, it will be appreciated that the subscriber's telecommunications equipment, as an alternative to being selected from alarm equipment, e.g., for giving warning of burglary, fire, theft, robbery or the like, may be selected from the group consisting of
30 telephone sets, data communication equipment, visual communication equipment, monitoring equipment (e.g., for an industrial production process), and automatic

warning aids. The subscriber's telecommunications equipment is generally designated by the reference numeral 4.

For simplicity, the invention will be described in connection with its use with alarm equipment, the subscriber's telecommunications equipment in this case consisting of an alarm unit 4 installed on the premises of the alarm subscriber. The alarm unit 4 can be triggered by detectors, generally designated by the reference numeral 5, e.g., IR detectors, contact sensors, heat sensors, manual triggers, fire detectors or the like. When the alarm unit 4 registers an alarm situation, it will emit an alarm, either optically or acoustically or both via an alarm output 6. At the same time the state of alarm is relayed to the microprocessor 3. Via its connection to the sensor circuit 1, the microprocessor 3 will be able to determine whether the ordinary physical telephone line is available for the transmission of alarm signals. If the sensor circuit indicates that one or more of the parameters listed above are present, the microprocessor 3 will swiftly seek to provide an alternative telecommunications path. Upon the establishment of an alternative telecommunications path, the subscriber's telecommunications equipment 4 will be connected to a selector circuit 5 via the microprocessor 3. Depending upon the signals which are to be transmitted, it will be necessary to have a signal type based modem between the microprocessor 3 and the selector circuit 5. The reference numeral 6 thus indicates a DTMF-based modem, whilst the reference numeral 7 denotes a modem which converts FSK or ASK signals to DTMF tones. Provided between the selector circuit 5 and the microprocessor 3, there is in addition a dialling tone generator 8 which can emit an approximate dialling tone, optionally at a somewhat higher frequency than usual. In some cases a dialling tone generator 8 of this kind is not necessary. The DTMF-based circuit 6 will behave like an ordinary transmitter/receiver. The circuit designated by the reference numeral 6 may also optionally handle pure pulse signals.

Since the alarm units 4 may be of different types as regards the carrier frequencies used for transmitting alarm signals, it might be necessary to down-convert frequencies above a certain frequency value, e.g., above 1400 Hz, to enable them to get through easily when the transmission is compressed. In some cases, it may therefore be necessary to

transform the signals originating from the subscriber's telecommunication equipment by converting from ASK to DTMF or from FSK to DTMF, as indicated for function block 7.

- 5 If it is necessary to convert ASK or FSK signals to DTMF signals for transmission via the alternative telecommunications path, it will be appreciated that equipment for converting such DTMF signals to ASK or FSK signals is advantageously provided on the premises of the receiving subscriber.
- 10 The microprocessor may be adapted to be programmable via a program memory 9 and optionally have a current-independent memory 10. In addition, a pure read-only memory 11 may be provided. Further modifications of the memory part of the microprocessor will of course be possible within the scope of the invention.
- 15 The microprocessor 3 will on external actuation be easily programmable via appropriate programming equipment.

If the sensor 1 finds that the telephone line 2 is not intact for telecommunication, it will trigger an alarm input 12 which causes the selector circuit 5 to disconnect its connection 20 to the telephone line 2 and connect the alarm signals via line 13 to an audio port 14 which is connected to the input on a transmitter, e.g., a GSM transmitter/receiver 15. At the same time the microprocessor 3 will be able to feed pure data signals to the transmitter/sender 15 via a series port device 16. The alarm signals, preferably in DTMF form, can thus be transmitted from the antenna 17 of the transmitter/receiver.

25 It will be appreciated immediately that the alternative telecommunications path may be two-way, so that when signals are received via the antenna 17, these can be relayed along the same path back to the subscriber's telecommunications equipment 4. If the microprocessor 3 on the input 12 registers that the sensor circuit has not detected faults 30 on the telephone line 2, the selector circuit 5 via connection 18 will feed the signals from the subscriber's telecommunications equipment to a line feed circuit 19, whilst

typical data signals are delivered from the microprocessor 3 via the line 20 to the line feed equipment 19. A ringing current generator 21 is connected to the line feed circuit 19. The ringing current generator 21 may be designed to be able to change the ringing frequency and pulse length of rings and pauses for the line feed circuit.

5

The ringing current generator 21 is normally necessary in order to trigger an alarm (if it is this that is the subscriber's telecommunications equipment) with a view to establishing the telephone connection, as there will normally be no ringing current from a GSM transmitter/receiver.

10

The various functional units of the arrangement are supplied with operating voltage from a power supply unit 22 via the output 23 thereof. The power supply unit may, for example, be connected to the mains, but it may also be equipped with back-up power supply, e.g., from rechargeable or non-rechargeable batteries, solar cell panels or the like.

15

The microprocessor 3 may optionally be equipped with several extra series ports 24 for the connection of other external equipment.

20 In addition, the microprocessor 3 may be equipped with one or more inputs 25 and outputs 26 for direct connection to alarm triggers and/or alarm-signalling equipment.

Signalling via the alternative communications path can take place either wirelessly via the GSM connection as shown and described, or the GMS transmitter/receiver 15 may 25 be replaced by another alternative telecommunications path selected from the group consisting of:

- another monitorable physical telephone line;
- a telecom connection via the mains;
- an optical cable connection;
- 30 an optical, non-physical connection;
- an ultrasonic communication connection;

radio communication via satellite; and
a radio connection via e.g., GSM, NMT, VHF, UHF.

The mode of operation of the arrangement according to the invention will, however, in
5 general be the same as that shown and described thus far.

It will also be understood that the arrangement according to the present invention will
not only be suitable for the transmission of signals, but also for the receiving thereof.

- 10 The present arrangement is thus capable of sensing whether an ordinary telephone line
is intact or not for telecommunication, and if it is not, the arrangement will
automatically choose an alternative telecommunications path for one-way or two-way
communication.
 - 15 In the cases where the telephone line may perhaps be unreliable, the arrangement may
optionally be programmed so as to primarily be connected to the alternative
telecommunications path, e.g., via a GSM transmitter/receiver. This may be particularly
relevant, e.g., in holiday cottages where a permanent telephone line is not normally
available.
- 20 In the event of an incoming call which is intended to test the arrangement, the
arrangement is able check that this is a genuine control call and not a call intended to
block the arrangement.
- 25 Further modifications of the arrangement according to the invention will of course be
conceivable within the scope of the invention. Thus it is possible to envisage that one
or more of the function blocks shown in the figure may be integrated in a larger
integrated circuit to make the arrangement as simple as possible in construction and any
necessary repairs.

Patent claims

1.

An arrangement for establishing an alternative telecommunications path between two
5 telephone subscribers via a telephone exchange in the event of inaccessibility via the
ordinary telephone line,

characterised in

- that a sensor circuit on the premises of at least one of the subscribers is adapted to monitor the telephone line between the exchange and the subscriber in order to
10 detect one or more of the following parameters:
 - voltage drop on the line without simultaneous line current
 - voltage failure on the line caused by line disruption;
 - absence of dialling tone on the line;
 - DTMF tones on the line;
 - unidentifiable DTMF tones on the line;
 - FSK signals on the line;
 - ASK signals on the line; and
 - pulse signals on the line.

- that a selector circuit is connected to the sensor circuit to connect the telephone
20 subscriber's telecommunications equipment from the telephone line to the alternative
telecommunications path upon the presence of at least one of said parameters, and that
the alternative telecommunications path is selected from the group consisting of:
- another monitorable physical telephone line;
 - a telecom connection via the mains;
 - 25 a radio connection, e.g., GSM, NMT, VHF, UHF;
 - an optical cable connection;
 - an optical, non-physical connection;
 - radio communication via satellite; and
 - an ultrasonic communication connection.

30

2.

An arrangement as disclosed in claim 1, characterised in that

- the subscriber's telecommunications equipment is selected from the group consisting of:
 - telephone sets;
 - 5 - data communication equipment;
 - visual communication equipment;
 - monitoring equipment, e.g., for an industrial production process;
 - alarm equipment, e.g., for giving warning of burglary, fire, theft, robbery or the like;
 - 10 and
 - automatic warning aids.

3.

An arrangement as disclosed in claim 1 or 2, characterised in that

- upon the establishment of an alternative telecommunications path the subscriber's
- 15 telecommunications equipment is connected to the selector circuit via one or more microprocessors.

4.

An arrangement as disclosed in claim 1, 2 or 3, characterised in that

- 20 - the selector circuit is connected to the microprocessor circuit(s) via a dialling tone generator.

5.

An arrangement as disclosed in claim 1, 2 or 3, characterised in that

- 25 - the selector circuit is connected to the microprocessor circuit(s) via a dialling tone generator and a transmitter/receiver.

6.

An arrangement as disclosed in claim 1, 2 or 3, characterised in that

- 30 - the selector circuit is connected to the microprocessor circuit(s) via a transmitter/receiver.

7.

An arrangement as disclosed in claim 5 or 6, characterised in that

- said transmitter/sender is of the DTMF, FSK, ASK or pulse type.

5

8.

An arrangement as disclosed in one or more of claims 1-7, characterised in that

- the microprocessor circuit(s) are arranged to provide a line feed circuit fed from a ringing current generator with ringing current for the subscriber's telecommunications equipment.

10

9.

An arrangement as disclosed in claim 5, characterised in that

- 15 - the ringing current generator is equipped to be able to change ringing frequency and pulse length of rings and pauses.

10.

An arrangement as disclosed in one or more of the preceding claims, characterised in

20 that

- the microprocessor circuit(s) is/are equipped with one or more inputs and outputs for connection directly to alarm triggers and/or alarm signalling equipment.

11.

25 An arrangement as disclosed in one or more of the preceding claims, characterised in that

- the microprocessor circuit(s) has/have inputs for programming thereof via external programming equipment, and also memory equipment.

30 12.

An arrangement as disclosed in one or more of the preceding claims, characterised in

that

- the microprocessor(s) is/are arranged to relay both outgoing and incoming communication via the alternative communications path.

5 13.

An arrangement as disclosed in one or more of the preceding claims, characterised in
that

- the sensor is adapted to trigger an alarm input on the microprocessor in the event of inaccessibility of the telephone line, to transmit an alarm via the alternative

10 communications path.

14.

An arrangement as disclosed in one or more of the preceding claims, characterised in
that signalling via the alternative communications path is based on the following

15 alternatives:

- voice band transmission;
- transmission via a data band, e.g., GSM;
- text transmission, e.g., SMS via GSM.

15.

20 An arrangement as disclosed in one or more of the preceding claims, characterised in
that the microprocessor circuit(s) is/are arranged to convert ASK or FSK signals into
DTMF signals for transmission via the alternative communications path.

16.

25 An arrangement as disclosed in claim 15, characterised in that on the premises of at least
the second subscriber there is provided equipment for converting DTMF signals into
ASK or FSK signals.

